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THESIS

IMPLEMENTING ELECTRONIC DATA
INTERCHANGE (EDI) AT THE
DEFENSE FUEL SUPPLY CENTER

by

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**IMPLEMENTING ELECTRONIC DATA INTERCHANGE (EDI)
AT THE
DEFENSE FUEL SUPPLY CENTER**

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Submitted in partial fulfillment
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ABSTRACT

This thesis examines the implementation of Electronic Data Interchange (EDI) at the Defense Fuel Supply Center (DFSC). The general history and concept of EDI is discussed along with a background on DFSC. The results of surveys of DFSC's employees and DFSC's contractors are analyzed to provide insight on the barriers and impediments of implementing EDI at DFSC.

The major conclusion drawn is that DFSC can successfully implement EDI in its operations with its contractors. It was determined that the following key factors are crucial to the successful implementation of EDI in this environment: 1) selection of the proper personnel to run the program; 2) proper training of all DFSC personnel that will interface with EDI; 3) the need to advertise DFSC's EDI program to its potential trading partners; 4) ability to recognize the EDI standards that have been adopted by the petroleum industry and to comply with them; and 5) ability to recognize when and where EDI best fits in to the organization's business process, and to only implement EDI in these areas. These efforts would allow DFSC to successfully integrate EDI technology into their operations in the most efficient manner.

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I. INTRODUCTION

A. BACKGROUND

The Department of Defense (DoD) is undergoing significant changes driven by world events, declining budgets, declining personnel resources, and political pressure to reduce the costs and complications associated with its acquisition and logistics processes. A key factor in the Department's efforts to streamline its business functions, without degrading military capability, is the use of information technologies.

Within the multitude of information technology applications available to today's business community, a specific discipline known as Electronic Commerce (EC) has started to play a major role in the business environment. EC is defined as "the conduct of administration, finance, logistics, procurement, and transportation between the Government and private industry using an integrated automated information environment to exchange business transactions." [Ref. 1:p. 16] EC, allows for the automated transfer of business information using today's modern communications devices. This form of information technology encompasses all forms of electronic exchange of business information such as electronic mail (E-mail), electronic bulletin board systems (BBS), facsimile (FAX), and electronic funds transfer (EFT). Critical to the definition of EC is the fact that these transactions usually require some human interaction for them to be processed and acted upon.

Advancing the automation of the business transaction one step farther brings us to the technology known as Electronic Data Interchange (EDI). EDI is "the computer-to-computer exchange of standard business documents such as purchase orders, invoices, and receiving

reports by means of standard formats called transaction sets."¹ [Ref. 2:p. 1-1] It is important to note how EDI differs from other forms of EC. First, consider FAX machines, which are commonly used in procurement offices for the fast communication between customers and suppliers. They are electronic communications; however, they require the use of paper and human intervention by both the sender and the receiver. Likewise, E-mail, which is also electronic communication, still requires human intervention at both ends of the process for anything to happen with the data contained in the transaction. To be called EDI, the transmission must be electronic, paperless, and without human intervention. A true EDI transaction is exchanged from computer-to-computer, where it is processed by the receiving computer, not by a person. It is through the use of EDI, that commercial businesses and the Government can replace the time-consuming and repetitive process of manually handling large volumes of standard business documents with an instantaneous, single-entry exchange of digital information between computers.

Although EDI has been researched and discussed for several years, implementation of this technology within the Federal Government has been very limited. Now, in the 1990s, legislative and executive direction, coupled with declining DoD resources, has resulted in the need to turn the concept of EDI into a functioning system within the Government. One of the DoD activities that is pursuing increased efficiency through the use of EDI technology

¹ A transaction set is an EDI document typically consisting of a group of data segments forming a complete document. An example would be a purchase order.

in their contracting environment is the Defense Fuel Supply Center (DFSC). As DFSC goes through the EDI implementation process, there are several potential impediments, or areas of concern, that must be addressed in order to provide for a successful implementation.

This thesis explores the issues surrounding DFSC's implementation of EDI in their contracting environment and attempts to develop an implementation strategy to assist in their automation efforts.

B. OBJECTIVE AND RESEARCH QUESTIONS

This paper examines the central issues surrounding DFSC's ongoing implementation of EDI in their procurement environment. The main thrust of this study is to explore the issues surrounding DFSC's implementation efforts and to uncover as many potential impediments to the implementation of EDI in their contracting operations as possible. The researcher explores the impediments, and recommends potential solutions or courses of action for DFSC to pursue in overcoming them in their worldwide operations.

The primary research question is what impediments must be overcome to achieve a successful implementation of Electronic Data Interchange (EDI) technology in the Defense Fuel Supply Center's (DFSC) contracting environment? Subsidiary research questions include:

- What is the current status of EDI technology within DFSC's contracting operations?
- What technology and computer hardware issues must be resolved?
- What concerns regarding EDI implementation exist with DFSC's personnel and the personnel in activities directly involved with DFSC contracting?
- Are there any unique aspects of DFSC's operations that may necessitate deviations from the EDI standards prescribed by the Department of Defense (DoD)?

- What implementation strategy should DFSC policy makers pursue in order to successfully achieve their and their customers' EDI goals?

C. METHODOLOGY

The methodology of this thesis research included a comprehensive literature search and examination of current documentation surrounding EDI, DFSC operations, and EDI usage throughout the DFSC's contractor base. Interviews were conducted with numerous DoD civilian and military personnel from the Office of The Secretary of Defense (OSD) level down to individual installation levels, along with surveys and interviews of several of DFSC's contractors. These interviews and surveys represent various levels of the acquisition process, e.g., acquisition policy, contracting personnel, EDI researchers/implementers, product users, etc. Additionally, the researcher attended EDI conferences sponsored by the American Petroleum Industry and DFSC.

An exhaustive review of current literature was performed on EDI. This literature review included the classic computer data base searches including: 1) Defense Logistics Studies Information Exchange; 2) Defense Technical Information Center; and 3) National Technical Information System; along with an ongoing search of the INTERNET.

A formal research survey was conducted of 327 of DFSC's current contractors, and follow up interviews were conducted with 27 of these companies to determine their current level of EDI knowledge/activity and ascertain their desires for further EDI implementation and steps that DFSC can take to improve their EDI capabilities. A separate formal survey

was conducted of 213 of DFSC's employees, with 34 follow up interviews, to determine their current level of EDI knowledge and acceptance and to explore what they perceived as implementation barriers and impediments.

D. LIMITATIONS AND ASSUMPTIONS

1. Limitations

The basis of this thesis is an intensive fifteen-month study of EDI and its potential application within the DoD. The final five months of the research concentrated on implementing EDI strictly within DFSC's operations. This thesis does not include an extensive discussion of the actual programming of EDI bridging, translation, and management software or a technical discussion of the computer and communications hardware required to implement EDI. However, these issues are addressed where they present potential impediments to DFSC's implementation plans. Rather, the thesis concentrates on the policy, personnel, and management issues involved in attempting to coordinate a successful EDI implementation.

2. Assumptions

Even though Chapters II, III, and IV provide a discussion of EDI and its potential application within the contracting environment, the researcher assumes the reader is familiar with the basic tenets of EDI and the Federal Acquisition Regulation (FAR). A reader who is not familiar with the Federal acquisition process will have to refer elsewhere for an in-depth explanation of the theory, principles, and regulatory basis for current practices.

The benefits of this study, while focused on one individual activity within DoD, is the discussion of the impediments that can confront any organization implementing EDI and the recommended solutions to those impediments.

E. ORGANIZATION OF THE STUDY

A comprehensive glossary of abbreviations and acronyms used in this paper is presented in the Appendix. Working definitions of terms and concepts used in this paper will be provided as footnotes when deemed necessary.

This research effort is organized into five chapters. Chapter I provided an introduction to the subject matter. Chapter II highlights EDI's development background, discusses the DoD's direction on EDI, provides a background on DFSC, and presents the current status of the use of EDI within DFSC. Chapter III presents and discusses the impediments to implementation of EDI in DFSC's contracting arena, from the perspective of DFSC's employees. Chapter IV presents and discusses the impediments to DFSC's EDI implementation program from the perspective of DFSC's commercial contractors and provides some detail concerning DFSC's contractors EDI environment. Lastly, Chapter V presents the researcher's final recommendations and conclusions.

II. ELECTRONIC DATA INTERCHANGE

A. EDI DEVELOPMENT AND BACKGROUND

EDI's end-to-end digital exchange of business information is being used as a catalyst for a management approach embracing continuous process improvement. EDI is a tool that can be used in efforts to move businesses from a paper-based domain to one that is dominated by electronic transactions. As the amount and complexity of information being exchanged within industry and the Government has increased, so too has the requirement to transfer these data in a more efficient and economical manner.

1. Standards

In the mid-1950s, computer-to-computer information exchange systems began appearing within DoD and many large private companies [Ref. 3:p. 1.0.2]. DoD used its unique electronic formats to ensure inter-operability of its logistical systems such as the Military Standard Requisitioning and Issue Procedures (MILSTRIP) and Military Standard Transportation Reporting and Accounting Procedures (MILSTRAP) programs. At the same time, companies like Sears, K-Mart, and Wal-Mart were each developing their own unique computer based information exchange systems [Ref. 4]. As a result, DoD and the large corporations using proprietary data were limited to electronic communications within their organization or direct company business base.

Due to the many different formats of EDI, expansion of EDI throughout industry and within the Government was seen as expensive and time consuming, if not totally impossible.

Therefore, EDI standards were a requirement if EDI was to further develop. The key to future implementations was the development of commercial standards for the format of specific business transactions.

These commercial standards eliminate the need to create special software to receive or send user-unique data formats. Instead, one software package designed to generate and interpret standard formats can be used to exchange information with all trading partners.² [Ref. 5:p. 1.0.3]

In order to overcome the limitations of specific company or organizational proprietary data formats, the early 1970s saw several industry associations develop common standards for conducting electronic communication within their business sector. Among these were the Transportation Data Coordinating Committee (TDCC) which addressed business in the rail, motor, air, and ocean industries. Other industry standards were developed within the grocery (Uniform Grocery Standard), chemical (Chemical Industry Data Exchange), and petroleum (Petroleum Industry Data Exchange) communities. For a short time period, these solutions allowed EDI to grow and expand beyond its original boundaries. The late 1970s saw EDI once again reaching its functional limitation due to the inability to conduct business across industry lines.

At this time, several of the industry associations took their problem to the American National Standards Institute (ANSI) for their help in developing a national EDI standard. In 1979, ANSI created the Accredited Standards Committee (ASC X12) to develop EDI standards that could cut across industry boundaries and allow for the electronic interchange of business transactions. The goal of the ASC X12 is to

² Trading partners is a term used in EDI to define two or more organizations who have an established business relationship. A common example being a buyer-seller relationship.

...structure standards so that computer programs can translate data to/from internal formats without extensive reprogramming. In this way, by using internally developed or commercially available software and private or public-access communications networks, ASC X12 believes that all sizes of firms and institutions using intelligent computational devices can benefit from use of the standard. The efficiencies of a standard interchange format can greatly reduce the difficulties and expense if each institution were to impose its own formats on every other institution with which it does business. [Ref. 6:p. iii]

In ASC X12, various subcommittees develop new proposed standards that are recommended to the full ASC X12 membership. Proposed standards must be approved through the consensus process before a standard, or any change to a standard, can be approved and requested through ANSI. The X12G Subcommittee deals with issues affecting Government; the X12K Subcommittee deals with issues associated with purchasing. The standards developed by ASC X12 include the documentation describing transactions sets, data segment directories, data element dictionaries, code sets, and interchange control structure.

ANSI's ASC X12 standard is widely used throughout U.S. commerce, but it is not used internationally. A second set of standards, developed by the United Nations, Electronic Data Interchange for Administration, Commerce, and Transportation (UN/EDIFACT) is dominant throughout many other areas of the world. These standards apply to international trade and are becoming more significant as the world moves toward a global economy. The ANSI X12 committee has decided to align the X12 standard with EDIFACT by 1997 [Ref. 7:p. 4-12].

EDI standards are intended to accommodate a full range of business activities for all industries. The resulting standards are very broad and are intended as a superset to meet the diverse requirements of all users. They commonly contain more data elements and structure

options than any one user, or industry, needs. In fact, they often contain optional ways of conveying the same information. Because of the broad nature of the basic standards, there are far too many opportunities for incomplete or ambiguous transactions. Therefore, actual implementations require Implementation Conventions (ICs) to fully define the transactions. ICs define the exact transactions required to conduct business by tailoring the use of the standards' segments, data elements, and code values. In addition they document the intended interpretation of a standard. For example, the Invoice (ANSI X12 810) transaction set can be used as a Commercial Invoice, a Progress Payment Request, and a Public Voucher [Ref. 8:p. 1]. The segments and data used in each of these contexts may be different. This process of refining standards for use in a particular context is required before trading partners can conduct business via EDI. As a result of this refinement of the standards that is required between individual trading partners, EDI still is characterized by some degree of proprietary type requirements within the particular industries. The industry associations that once were in the business of defining EDI format via transaction sets, now develop their industry's ICs.

2. Federal Government Direction on EDI

On May 24, 1988, Deputy Secretary of Defense Taft directed that DoD join the private sector as a full trading partner in EDI and make "maximum use of EDI for the paperless processing of all business-related transactions." [Ref. 9:p. 1] Additionally, Taft directed that DoD utilize the ANSI X12 standards for conducting the transactions.

On May 7, 1990, Deputy Assistant Secretary of Defense (Production and Resources) Torelli designated the Defense Logistics Agency (DLA) as the Executive Agent for EC/EDI within DoD. In June of 1990, DLA established an executive agent plan of action to integrate

defense components and maintain standardized systems and procedures for EDI implementation within DoD. Under this plan, each DoD component is responsible for identifying current and planned initiatives, mapping interfaces with related systems, and operating EDI at its respective sites.

On November 12, 1991, DoD's implementation of EDI systems was further accelerated by the Defense Management Review Decision 941 (DMRD 941), "Implementation of Electronic Data Interchange in DoD." [Ref. 10:p. 1] The thrust of DMRD 941 was to achieve full operational EDI capabilities at the earliest possible date. Beginning in Fiscal Year (FY) 1992, DMRD 941 programmed budget and end strength cuts into each Military Department and DLA. The cost reductions reflect the direct savings projected with the use of EDI transactions.

More recently, in September 1993, the National Performance Review (NPR), headed by Vice President Gore, focused on how the Government should work. The resulting report targeted procurement as one of three major areas for reform. The suggested procurement reforms included concepts of allowing agencies to buy where they want through an "electronic marketplace." [Ref. 11:p. 2]

Another important initiative was the President's Memorandum, "Streamlining Procurement through Electronic Commerce," issued on October 26, 1993. In this, the President directed the accelerated implementation of EC across the executive branch of the Federal Government. Further, he mandated a standard architecture for EC for the procurement function be developed by March 1994. This memorandum established an ambitious implementation schedule with complete Government-wide implementation of EC

for appropriate Federal purchases, to the maximum extent possible, by January 1997. [Ref.

12] Table I displays the requirements of the President's memorandum:

Date	Goal
March 1994	Define the architecture for the Government-wide electronic commerce procurement system and identify executive departments or agencies responsible for developing, implementing, operating, and maintaining the Federal electronic system.
September 1994	Establish an initial electronic commerce capability to enable Federal Government and private firms to electronically exchange standardized requests for quotations (RFQs), quotes, purchase orders, and notice of awards. Begin Government-wide implementation.
July 1995	Implement a full-scale Federal electronic commerce system that expands initial capabilities to include electronic payments, document interchange, and support data bases.
January 1997	Complete Government-wide implementation of electronic commerce for appropriate Federal purchases to the maximum extent possible.

Table I. Milestones Established in Presidential Memorandum

Even after all of this direction and guidance from within the Executive branch of the Government, development and implementation of EDI capability within the Government has proceeded slowly. Finally, in October of 1994, the Federal Acquisition Streamlining Act (FASA) provided direct motivation for activities to pursue EDI implementation. Under the provisions of FASA, activities are rewarded for achieving implementation of EDI technology, under the Government's Federal Acquisition Computer Network (FACNET), by being able to take advantage of acquisition streamlining procedures tied to the Simplified Acquisition Threshold (SAT). Once an activity is certified as possessing FACNET capability, they can instantly raise their SAT from \$50,000 to \$100,000, and take advantage of the benefits of the

streamlined acquisition procedures. [Ref. 13:sec. 4201] At last the "stick" of decreasing Federal budgets and personnel resources is being balanced by the "carrot" of reduced procurement regulation for activities that implement EDI.

3. The Defense Fuel Supply Center

As early as 1941, petroleum was singled out for coordinated control and the Secretary of the Interior was appointed as Petroleum Coordinator for the National Defense. In 1945, the Joint Army-Navy Petroleum Purchasing Agency was formed under the War Department. The name was changed to the Armed Services Petroleum Purchasing Agency in 1948 and again in 1957 to the Military Petroleum Agency. In 1962, it became the Defense Petroleum Supply Center, a charter member of the Defense Supply Agency, now called the Defense Logistics Agency. In 1964, it was named the Defense Fuel Supply Center. In 1973, DFSC progressed from a fuel central procurement activity to a more comprehensive mission as the Integrated Material Manager (IMM) for DoD petroleum requirements. Implementation occurred in two phases. Under Phase I, DFSC managed the acquisition, storage, distribution and sale of fuel with responsibility ending at the Service installation boundary. In 1991, the Office of The Secretary of Defense directed the completion of IMM, termed Phase II, which expanded DFSC's ownership of bulk petroleum products to include most bulk storage installations. The result is that DFSC now owns all bulk petroleum product from the point of purchase to the end use by the customer.

In their present role as a petroleum manager, DFSC not only supports the Military Services, but over 4,000 Federal agency customers ranging from the national parks system to the nation's Capital, to isolated Alaskan villages. The Center purchases more light

petroleum products than any other single organization in the world. With a \$4.4 billion annual budget, DFSC procures over 148 million barrels of petroleum products. DFSC manages 47 national stock numbers for petroleum products required by their customers' needs. Their products include jet fuels, aviation gasoline, automotive gasoline, heating oils, power generation oil, Navy propulsion fuels, lubricants, natural gas and coal.

With headquarters at Fort Belvoir, Virginia, DFSC is one of six inventory control points within DLA. The center manages four Continental United States (CONUS) regional offices (West, South, Central, and Northeast) and three international offices (Europe, Pacific, and Middle East), providing petroleum services worldwide. Although the Center's workforce handles about 40 percent of DLA's procurement budget, the 800 DFSC employees worldwide account for a relatively small percentage of the DLA workforce. DFSC's organization is comprised of management analysts, chemists, contracting officers, environmental engineers, computer programmers, inventory managers, auditors, economists, attorneys, quality assurance representatives, and more.

DFSC's contracting base ranges from small, local operations to the industry's leading manufacturers. Their top ten contractors are multi-national refining and distribution corporations. These top ten contractors represent approximately \$1.5 billion of the center's annual business. The entire contractor base consists of almost one thousand companies.

DFSC manages its petroleum programs through five internal divisions known as Commodity Business Units (CBUs). This organizational structure, which was put in place in late 1995, consists of cross-functional-teams, each of which manage one of the following DFSC programs; Bulk contracts; Direct Delivery Fuels (Posts, Camps, and Stations;

Intoplane; Bunkers); and Alternative Fuels (Gas and Coal) programs. The teams consist of the technical, inventory, and procurement personnel required to support the particular program's objectives. Support to the CBUs is provided from DFSC's Business Information Center (BIC), which provides policy, legal, and other corporate services while the Defense Systems Design Center (DSDC), which was established by DLA in 1995 as a consolidated Automated Data Processing (ADP) organization, provides computer hardware and software support.

a. DFSC's EDI Efforts

DFSC's EDI program began on May 28, 1991 when DoD approved a Program Implementation Plan (PIP) for EDI at DFSC. The PIP established an aggressive step-by-step plan for fully integrating EDI into DFSC's business activities. In August of 1993, DFSC established an EDI Division to take charge of their EDI implementation efforts. This division was staffed by contract specialists and computer programmers. Since that time, DFSC has established trading partner relationships with twenty three of its contractors and implemented the Price Change Notifications (ANSI X12 832), Invoice (ANSI X12 810), and Invoice Return Notification (ANSI X12 824) transactions. Current DFSC plans call for implementation of the Ship Notice Manifest (ANSI X12 856), Quality Test Data (ANSI X12 863), Receiving Advice (ANSI X12 861), and Inventory Advice (ANSI X12 846) transactions in the coming years.

In late 1995, in conjunction with the establishment of the cross-functional-teams/CBU organization, DFSC refocused its EDI efforts by shifting primary EDI responsibility away from a centralized organization down to the CBU level. For EDI

purposes, each DFSC region is also considered a CBU. The CBUs are required to designate an EDI point of contact who is responsible for originating EDI projects, managing implementation of the projects, participating in a centralized EDI Council, marketing EDI transactions to DFSC's customers and suppliers, and establishing new trading partners. An EDI office was also established within the BIC with responsibilities of coordinating proposed projects with other CBUs, coordinating projects with outside agencies, chairing the DFSC EDI Council, maintaining EDI documentation (Trading Partner Agreements (TPAs), Addenda, etc.), serving as DFSC's representative to the DLA EDI Coordinating Committee, maintaining EDI statistics, ensuring regulatory compliance of DFSC's EDI program, funding EDI projects, tracking EDI savings, and coordinating DFSC representation at EDI conferences and seminars.

B. SUMMARY

This chapter introduced EDI from the perspective of the need for standardization and explored the Federal Government's policies on EDI implementation. Additional information was provided on the operations of the Defense Fuel Supply Center and their EDI implementation efforts to date.

The next chapter presents and discusses the issues involved with DFSC's EDI implementation effort, from the perspective of the DFSC employees.

III. EDI IMPLEMENTATION FROM THE DFSC EMPLOYEES' PERSPECTIVE

A. GENERAL

The benefits of implementing EDI in a Government organization or private enterprise have been well documented by previous research and throughout the business literature. Some of the advantages identified include: reduced costs and time associated with conducting business transactions, improved accuracy of business transactions, increased efficiency of personnel, lower cost due to the reduced production and storage of paper documents, and faster payment processing times [Ref. 5:p. 10]. With these benefits of EDI well defined, the logical question becomes: Are there any factors that may inhibit the implementation of EDI within DFSC's business operations? This chapter exposes the reader to the results of the researcher's surveys and interviews with DFSC's employees concerning the potential impediments to DFSC's EDI implementation.

In order to evaluate the impediments and issues involved with the implementation of EDI at DFSC, 213 of DFSC's employees were given a formal survey, followed by in-depth interviews with 34 employees. These surveys and interviews were intended to determine each employee's current level of EDI knowledge and acceptance, and to explore what they perceive as EDI implementation barriers and/or impediments.

1. Question 1

The first question asked in the surveys was: Are you aware of DFSC's ongoing efforts to implement Electronic Data Interchange in its operations? The question was designed to

determine to what extent DFSC's employees had been exposed to the EDI concept in their work environment.

a. Response

Of 213 personnel surveyed, 153 (71.8%) responded that they were aware of DFSC's EDI program. However, the majority of the respondents indicated that their only exposure to the program had been at an "all hands" lecture given in 1994. With very few exceptions, the employees stated that they were unaware of any ongoing efforts to involve more people in the program's efforts or to provide further training.

b. Analysis

The survey and follow up interviews indicate that there is a lack of an ongoing training program for the Center's employees. What training has been provided appears to be of a general nature and has not been in a detailed level that focuses on specific employee groups or functions.

2. Question 2

After gaining a sense of the EDI awareness within the organization, the survey was designed to determine if personnel felt comfortable with their current EDI knowledge level as it relates to their job. The following question was posed: Do you feel you have adequate knowledge about the EDI process to be an active player in the areas where you will be involved in DFSC's implementation?

a. Response

Of 213 personnel surveyed, only 43 (20.2%) responded that they possessed adequate knowledge for what they perceived as their role in the DFSC EDI program. In

evaluating the survey responses, the personnel who had responded previously that they were not aware of DFSC's ongoing EDI efforts, were not excluded from analysis due to the fact that seven of them responded that they did have adequate knowledge of the EDI process, even though they were not aware of DFSC's efforts. Upon follow up interviews with four of these seven personnel, three indicated that they had gained significant knowledge of EDI through their own efforts. The fourth person expressed that she was certain she would not be involved in EDI, and therefore, she felt her lack of knowledge was still adequate for her requirements. Some of the specific comments that were indicative of the overall survey results were: "I do not feel comfortable speaking with contractors about the EDI process since I really have not been properly trained in the field." and "DFSC's program to date has been like a secret project for the EDI team. Some of those people have been protecting their EDI knowledge in an apparent effort to advance their own careers and have been very reluctant to answer questions or provide education to their fellow employees."

b. Analysis

The results from this portion of the survey give further indication of a possible lack of a concentrated EDI training program. Despite the relatively high level of program awareness, this question indicates that most of the employees' EDI knowledge may be inadequate for them to actively participate in, support, and advance DFSC's EDI program.

3. Question 3

In addition to assessing the EDI awareness and knowledge levels, the survey was designed to determine what business function DFSC employees would like to see automated,

potentially by EDI. The third question was: What is the most important business function/transaction you would like to be able to accomplish with your contractors via EDI?

a. Response

The top five responses are displayed, by percentage, in Figure 1. In several instances respondents indicated that they hoped automation of the specific transaction would allow them to accomplish their work in a more timely manner and allow DFSC to better cope with DoD's personnel downsizing initiatives.

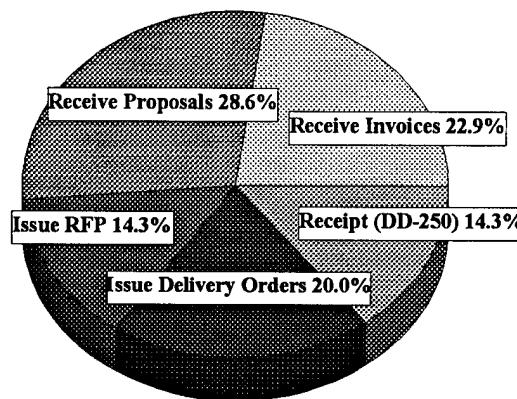


Figure 1. Most Desired EDI Transaction (DFSC Employees)

b. Analysis

These results reflect the transactions or business functions that use most of the DFSC employees' labor hours or are most redundant in processing. As expected, the employees' EDI objectives appear to center around automating the workload at their end of the process, instead of a concern for the processes of their contractors. Fortunately for DFSC's implementation program, each of the transactions desired by the employees has potential for implementation using the currently developed ANSI X12 EDI transaction sets.

However, the third most desired transaction, issuing delivery orders, may encounter opposition from DLA Headquarters. Senior procurement officials there are contemplating issuing a policy that will prohibit DLA activities from issuing delivery orders, which may be time sensitive, via EDI due to concern about the timeliness of delivery of EDI transactions in the existing DoD computer/communications environment [Ref. 14]. Specifically, officials are concerned with the transmission method for EDI transactions under the prescribed DoD communications architecture.

EDI transactions between trading partners can be delivered in many ways, ranging from the hand delivery of magnetic computer tapes or disks to the use of electronic transmission via standard electronic communications technologies. The most common approaches used in commercial industry, both utilizing electronic communications, are the "direct connection" method or use of a "Value Added Network (VAN)."

Under the direct connection process, trading partners transmit data directly from one partner's computer to the other's via commercial phone systems. For activities doing business with only a few trading partners, this approach is viable, and can be very cost effective. However, for activities doing business with a multitude of trading partners, this method quickly becomes cumbersome and expensive. To service each trading partner, a specific time must be arranged for both trading partner's computers to be available for the transmission. Required connection time between the computers can run from a few seconds to a few minutes, depending on transaction volume and computer/communications systems capabilities. As the number of trading partners and volume of transactions grows, the direct

connection method of communications can quickly tie up a computer system and its support staff for several hours out of a day. Additionally, the ability to communicate between any two specific trading partners more than one time per day can be severely limited due to the need to schedule communications times with the remaining trading partners. As a result of these limitations, direct connect communications is not a viable option for most DoD activities.

Under the VAN concept, trading partners send their EDI transactions to a VAN rather than directly to the affected trading partner. The EDI VAN is a communications network that transmits, receives, and stores messages for EDI trading partners, generally through an electronic mailbox. Using this service, trading partners can access the VAN, deliver messages for several trading partners and receive messages from several trading partners, all in one phone call. Messages left for other trading partners are stored in the VAN mailbox until the designated trading partners log in and receive their mail. Trading partners can access the VAN weekly, daily, hourly, or more frequently as their business practices dictate. By using this communications method, the "direct connect" method's problems of transmission coordination, and the excessive time required to communicate with several trading partners on an individual basis, are eliminated.

In its implementation plans, DoD has adopted a modified version of the VAN communications process, by essentially creating a DoD VAN, that communicates with the industry utilized commercial VANs. This is done via what DoD calls its Network Entry Points (NEPs). Under this planned architecture, all DoD activities will transmit their EDI transactions via two NEPs operated by the Defense Information Systems Agency (DISA),

where they are then consolidated and transmitted to the commercial VANs that have registered with DoD. Currently DLA is utilizing the services of a NEP operated by the Defense Automated Addressing System Center (DAASC), which is successfully processing DLA's EDI traffic. However, DLA has been directed to switch to the DISA NEPs by 1996.

[Ref. 1:p. 118-127]

It is this communications architecture choice that has created concern with DLA's procurement leadership. Early experience has shown that DISA's systems are not capable of efficiently processing the existing volume of DoD EDI transactions in a timely or consistent manner. Several DoD activities are in the process of documenting their experiences of having EDI transactions lost or delayed for hours and days when being processed through DISA's NEPs. [Ref. 14] [Ref. 15] Based on DISA's performance to date, DLA is attempting to delay their directed migration to the DISA NEPs [Ref. 16] In view of these difficulties, DLA's leadership is very hesitant to allow their time sensitive transactions to be converted to the EDI process at this time.

4. Question 4

The next section of the survey was designed to discover what concerns and/or recommendations DFSC's employees have regarding the implementation of EDI technology in their business environment. Three questions were posed to the employees in this area.

Based on the fact that the use of EDI technology in Federal Government contracting is a relatively immature process, and that as a result, legal policy and case history may not be extensive, question four was designed to focus the employee's attention on the legal aspects of Government contracting using this communications technology. The question was posed:

Do you have any concerns or recommendations dealing with the legal issues involved with EDI's use in the DoD/DFSC contracting environment?

a. Response

The survey respondents focused on three specific legal issues, with the most prominent concern centered on the need to be able to authenticate the origination of the contract documents. This concern was expressed as "How does EDI satisfy the requirement for signatures on the various contract related documents?"

b. Analysis

Uniform acquisition policies and procedures for Federal Government agencies are set forth in the FAR. While the DoD and other Government agencies have initiated many EC projects, the FAR does not recognize current EDI capabilities as an accepted means of doing business in the contracting field. [Ref. 17:p. 2-2] Specifically FAR 4.101 states

(a) Only contracting officers shall sign contracts on behalf of the United States. The contracting officer's name and official title shall be typed, stamped, or printed on the contract. The contracting officer normally signs the contract after it has been signed by the contractor. The contracting officer shall ensure that the signer(s) have authority to bind the contractor.

Even in the area of small purchases, where the Federal Government's EDI efforts have been concentrated, the FAR is very restrictive on the use of electronic transmissions. Specifically, FAR 13.506 states

Purchase orders via written telecommunications. (a) A written telecommunicated purchase order for supplies or services that is electrically transmitted to a supplier and is not signed by the contracting officer. (b) A written telecommunicated purchase order may be used only when all of the following conditions are present: (1) Its use is more advantageous to the Government than any other small purchase technique. (2) An unsigned transmitted order is acceptable to the supplier. (3) The order is approved by

the contracting officer before its transmission. (4) The order does not require written acceptance by the supplier. (5) The purchasing office retains all contract administration functions.

Despite these restrictions in the FAR, current technology presents several methods for EDI to satisfy the requirement for signatures. For an electronic signature to be enforceable, an appropriate level of assurance must be in place to authenticate the originator's identity. These basic controls for signatures must:

- be unique to the signer
- be capable of verifications
- be under the signer's control
- be linked to the data being sent [Ref. 17:p. 3-4]

Simple signature techniques are based on identification and password security where an individual's authorization to perform or approve certain actions is granted by a defined level of access. Evidence of an action is recorded against that individual's user identification. One of the most commonly used commercial authentication methods is

Message Authentication Code (MAC). Under the MAC concept

...both the sending and receiving trading partners have secret encryption/decryption keys. The electronic transmission and the sender's keys are entered into a sophisticated algorithm called the Data Encryption Standard (DES), which is located between the EDI translation software and the telecommunications software. The DES creates a special authentication code that is unique to the particular message and key combination. The code is appended to the message and transmitted with the key to the receiver. The receiving trading partner breaks off the authentication code (the transmitted MAC) and runs the message and the keys back through the DES, which generates a second code. This code is then compared to the transmission code. If they are identical, then the message has not been altered, and is verified as coming from the other holder of the secret key. [Ref. 17:p. 5-5]

A second commercial authentication method is Public-Key Cryptology (PKC), which uses a series of complex algorithms in conjunction with two keys. The basic idea behind the PKC technology is

...PKC is a system that uses two keys. One of the keys is public and the other is private, and it is not possible to deduce a private key from a public one. A person with the public key can encrypt a message, but only someone with a private key can decrypt it. PKC algorithms are complex and therefore are not well suited to encrypting long messages, but PKC can be used to send the key for a different cryptographic algorithm, which is then used to encrypt and decrypt messages. The Digital Encryption Standard (DES) is used this way. [Ref. 17:p. 3-4]

This type of system would have the following benefits:

- It requires no ongoing business relationship between sender and receiver.
- It allows signatures and authorizations to be proven at a future time.
- It secures co-signatories and counter signatures.
- It eliminates the burden of administering a secret key system. [Ref. 17:p. 3-4]

Given this currently available technology, the Federal contract boards have started to recognize the capabilities of EDI. In a 1991 legal opinion concerning electronic contracting, the General Accounting Office (GAO) stated:

The Federal Government contract formation does not require a written document and that contracts may use electronic signatures to signify the contracting parties' intent to contract. [Ref. 18]

c. Response

The second concern voiced by DFSC's employees also centered on the ability to authenticate the EDI transmission. Here, they were specifically concerned with the integrity and legal validity of the actual data in the message that was being transmitted. Their

concern was expressed as "Will EDI transactions and their related electronic files be accepted as evidence by the courts and boards who hear Government contract disputes and protests?"

d. Analysis

This concern of the employees actually encompasses two factors involved with the EDI message. The first of these is the need to be sure that the message that is sent by the trading partner has not been altered in any way. Here, existing technology, in the form of "hash algorithms," can allow for the security of the transmitted message. Under the hash algorithm concept

...a hash algorithm does not involve encryption to verify the integrity of the message. A hash total is generated by the sender of a message, based on the data contained in it, and the recipient uses the same algorithm to generate a matching hash total if the message is unaltered. Intentional alteration of the message and the generation of a new hash total by an intruder could defeat the purpose of the hash total. However, if the process is carried one step further with the recipient returning the hash total to the sender for verification, the risk of undetected alteration is significantly reduced. [Ref. 19:p. 4-20]

Once the integrity of the data is ensured, the next issue becomes the ability to use this electronic data in legal proceedings. The Government's historical guidance on using standardized forms and paper storage methods for documents was based on the realities and practices of the time. Technological improvements in document storage and capabilities, as well as transmission and security capabilities, now provide the same or increased level of control and security as previous methods. A 1991 legal memorandum opinion from the GAO, provides support that EDI documents meet the statutory requirement of 31 U.S.C. 1501, which defines legally admissible court documents:

Although the types of contracts formed using EDI are stored in a different

manner than those of paper and ink contracts, they ultimately take the form of visual symbols. We believe that it is sensible to interpret federal law in a manner to accommodate technological advancements unless the law by its own terms expressly precludes such an interpretation, or sound policy reasons exist to do otherwise. It is evident that EDI technology had not been conceived nor, probably, was even anticipated at the times section 1501 and the statutory definition of 'writing' were enacted. Nevertheless, we believe that, given the legislative history of section 1501 and expansive definition of writing, section 1501 and 1 U.S.C. Sec 1 encompass EDI technology. [Ref. 18]

e. Response

The final legal issue DFSC's employees expressed involves the ability to determine when an EDI transaction is officially received by the Government. Employees are concerned with the specific rules governing the submission of bids under the Government's Sealed Bidding method of contracting. Their concerns are summarized by the statement: "What are the rules governing timeliness of bids under EDI?"

f. Analysis

In this area, FAR 14.304, which addresses "Late bids, late modification of bids, or late withdrawal of bids," is silent on the issue of bids submitted via electronic communications. Likewise, the rules and case law governing mailed or hand delivered bids do not appear easily adaptable to the use of EDI technology. However, a hint at potential Government policy on this topic is contained in a statement in the Federal Electronic Commerce Acquisition Team's 1994 report on Streamlining Procurement Through Electronic Commerce: "Receipt of a transaction at the first government-controlled EC system constitutes possession by the government. " [Ref. 19:p. 2-16] If this statement were to become official Government policy, there would still need to be clarification of what constitutes the "first

government-controlled EC system." Given the current Federal EDI communications architecture that utilizes the DISA's NEPs, would receipt by this agency, outside of the procurement offices, constitute receipt by the Government?

An alternative to this potential policy exists with the use of an existing EDI transaction set. By utilizing the Functional Acknowledgement (ANSI X12 997) transaction set, generated by the receiving activity's EDI system, with an accompanying electronic date-time stamp, all parties to the transaction could be certain of the time of receipt by the procurement office.

5. Question 5

Recognizing that the implementation of EDI potentially requires a combination of purchasing and/or developing new computer and communications hardware and software, the survey shifted focus to this environment. Question four asked: Do you have any concerns or recommendations dealing with the computer hardware, software, and/or communications systems that will be used to accomplish the EDI implementation?

a. Response

Significant areas of concern focused on four topics, the first of which is: "Are DFSC's computer software applications capable of adequately supporting operations in an EDI environment?"

b. Analysis

DFSC currently performs their contracting operations using a software application resident in the Defense Fuel Automated Management System (DFAMS) AIS. DFAMS serves the Center in managing bulk petroleum from procurement, through storage

and transportation, to final sale to the customer. While this AIS provides integrated contract management, its ability to support the implementation of EDI is limited. This is due to the program's 1970s era database architecture, which makes the process of EDI transaction "mapping" very labor intensive. In the mapping process, individual programs must be written for each EDI transaction, which identify where the required data elements for the transaction set reside in the AIS, and then extract these elements and align them in the proper format for export to the EDI translation software package. Under DFAMS, the mapping of individual transactions has historically taken DFSC's computer technicians anywhere from several weeks to several months to accomplish, due to the complex structure of the DFAMS database.

Beginning in 1996, DFSC will begin implementation of a replacement AIS that is being developed by Oracle Corporation. This AIS, which is based on Commercial-Off-The-Shelf (COTS) technology, offers the greatly improved data mapping capabilities of modern computer software applications. While DFSC's AIS project with Oracle is strictly for replacement of the inventory management portion of DFAMS, Oracle has available COTS automated procurement/contract management software under a 1995 General Services Administration (GSA) contract, that would allow DFSC to implement an integrated EDI process between all functional software applications. However, to date DFSC's request for approval to implement this procurement software has been denied by the DoD Corporate Information Management-Procurement (CIM-P) council, because it does not support the CIM initiative to develop a standard procurement system for use by all DoD activities. The CIM-P council, established to manage the standardization of all DoD acquisition AISs, as directed

in the Defense Management Review (DMR) program, controls the DoD budget for any functional improvement of existing systems, or acquisition of any new systems [Ref. 20:p. 7].

c. Response

The second issue surfaced by the survey concerns the: "Ability of the Defense Information Systems Agency (DISA), who is tasked with providing the communications link between DoD and the contractor community, to meet the high data volume requirements that will exist when all DoD activities begin using EDI."

d. Analysis

As previously discussed in the analysis of the DFSC employees' "most desired EDI transactions" in question three, DISA's two NEPs are intended to provide consolidated transmission services for all of DoD's EDI transactions. As more DoD activities begin implementation of EDI, DoD's choice of this communications architecture, and the corresponding ability of DISA to provide responsive communications service, will surely be tested.

e. Response

The DFSC employees' third area of technical concern addresses the: "Level of computer programming support available from DLA's new consolidated Defense Systems Design Center (DSDC)."

f. Analysis

The DSDC, which was established by DLA in 1995 as a consolidated ADP organization, provides computer hardware and software support to all of DLA's Inventory Control Points (ICPs). Under this concept, DSDC personnel provide all ADP support

services to each of the six ICPs from a centrally managed organization. With the implementation of this approach, the individual ICPs lost the dedicated services and control over the personnel who were previously attached to their organization, and who had developed the expertise on their unique AISs. While the services of these personnel are still available from the consolidated DSDC organization, DFSC's management must take active measures to ensure these personnel remain responsive to the Center's needs, especially in a changing ADP environment.

g. Response

The fourth concern expressed by the DFSC work force centers on the issue of EDI standardization. They presented the issues of: "What EDI standards, particularly Implementing Conventions, will DFSC be allowed to use?

h. Analysis

One of the primary visions of the Federal Government in their implementation of EDI technology in the contracting environment is to present a "Single Face to Industry." This concept is based on the idea that:

Many departments and agencies have already implemented or begun to implement EC. Each organization invents a slightly different version of what the other organizations have already implemented. In doing so, the trading partners have to deal with a new way of doing business for each of these organizations. The overall benefits of developing a standard approach to EC for the Federal Government and its trading partners will far outweigh any adjustments required to existing systems and practices. [Ref. 19:p. xiv]

In the area of Implementing Conventions, the Federal policy will focus on the idea that:

We must minimize the need for our trading partners to reprogram their systems or purchase different software to handle each agency's procurement system data structure.

Agencies using EC have their own implementing conventions (ICs). (Conventions are subsets of a standard. They provide efficiency while still allowing variations required by industry, procurement type, or other variables.) Although all these implementations are based on standards, variations result from interpretation or an attempt to incorporate the requirements of agency-specific application systems. Multiple implementations are inefficient for both the trading partner and the government. At ECAT's request, agencies recently identified data required from the supplier or by the supplier to complete acquisition transactions. By focusing on these external requirements, we will reach consensus and develop a single Federal IC for each transaction. [Ref. 19:p. xvi]

However, long before the Federal Government entered the world of EDI, the major industry associations of the U.S. developed standard implementing conventions for their specific business environments. In the petroleum industry, this function is performed by the Petroleum Industry Data Exchange (PIDX). PIDX is the EDI Standards Committee of the American Petroleum Institute (API), the primary trade association representing all phases of the oil and gas industry. Through this committee's efforts, the API Implementing Conventions have been established and are maintained in an ongoing interaction among industry representatives. The API ICs are currently used by over 750 independent activities doing business via EDI in the petroleum industry. [Ref. 21]

In its mission as the Integrated Material Manager (IMM) for DoD petroleum requirements, DFSC is the only Government agency contracting directly with the U.S. petroleum companies on a routine basis.

6. Question 6

The final area of the survey focused on the intangible issue that allows any program to succeed or fail. The fifth question asked: "Do you have any concerns or recommendations regarding the personnel issues involved with the EDI implementation?"

a. Response

On this topic, several ideas occurred frequently in the survey responses, the most prominent of which was: "Lack of training/education for all DFSC employees who will be involved with EDI."

b. Analysis

As previously discussed when analyzing the EDI knowledge level of the employees in question two, 79.8% of the employees do not feel they have adequate knowledge for what they perceived as their role in the DFSC EDI program. The only formal training efforts identified by the employees, aside from the all hands orientation lecture that was given in 1994, was DFSC financed attendance for CBU representatives at the API's Fall EDI Conference in October of 1995.

c. Response

The second area of concern in the personnel arena centers on the support provided to the EDI program from the various levels of management within the organization. The DFSC employees expressed two specific concerns: "Lack of support from all levels of DFSC management." and "**Resistance to change by some DFSC personnel.**"

d. Analysis

Two specific comments from the survey respondents are indicative of a general feeling that was present in a large number of the overall responses:

My team contracting officer said, EDI will be the greatest disaster to hit contracting. Next, she became the division chief and she still said, EDI will be a disaster. Now she is a GS-15 head of the directorate. She called a directorate meeting and stated that we have to break the paradigm and she fully supported EDI. Nobody in the directorate believed her and all said, "she was parroting what higher management told her to say."

EDI is here to stay. But, it won't see its full potential until most of the middle and senior management retires or leaves the government. We have people who still don't like computers and refuse to use them to their full potential. I have read all of the directives and know what senior management wants, but "the audio is not matching the visual." If the same people who are in charge of making changes don't want to change, then change won't happen.

e. Response

The third difficulty employees expressed was a: "Resentment of the way personnel assigned to prior EDI implementation teams have handled the program."

f. Analysis

Prior to the Fall of 1995, DFSC's EDI implementation team was a separate division within the organization. This division, established in 1993, was staffed by contract specialists and computer programmers who were pulled from their functional divisions to run DFSC's EDI program. Under this scenario, these employees no longer had an inter-office working relationship with the personnel who would actually be using the EDI systems in their day-to-day work. As relayed in the survey responses and during personal interviews, many employees viewed this group with a level of animosity due to the fact that members of the group enjoyed privileges that were not available to other employees of similar grade and

experience level. Specifically the EDI team members commonly had the opportunity to brief the top levels of DFSC's management regarding their program, and interacted with the directorate heads of the functional areas, vice interacting with the "front line" employees in those functional areas.

In the Fall of 1995, in conjunction with the establishment of the cross-functional-teams/CBU organization, DFSC refocused its EDI efforts by shifting primary EDI responsibility away from a centralized organization down to the CBU level. The CBUs have designated an EDI point of contact who is responsible for originating EDI projects, managing implementation of the projects, participating in a centralized EDI Council, marketing EDI transactions to DFSC's customers and suppliers, and establishing new trading partners. In this new organizational structure, the EDI team members will remain as an active member of their functional group, thus remaining in day-to-day contact with the "front line" employees.

g. Response

The fourth personnel related issue surfaced by the DFSC employees concerns the coordination of any project, in a large organization. The survey respondents focused concern on the: "Difficulty in coordinating a program of this magnitude across an organization doing business in offices throughout the world." and "**Difficulty in coordinating and implementing EDI at DoD activities and locations, that are not under the control of DFSC, but play essential roles in DFSC's business processes.**"

h. Analysis

As discussed earlier in this paper, DFSC manages four CONUS regional offices (West, South, Central, and Northeast) and three international offices (Europe, Pacific,

and Middle East), providing petroleum services worldwide. While these regional offices are staffed by employees who report directly to DFSC Headquarters, in fulfilling their worldwide mission, DFSC's business processes involve employees from all of the DoD Services, as well as numerous other Federal agencies. From developing requirements and placing orders against DFSC's contracts, to the final actions of accepting and certifying product deliveries, day-to-day operations that affect DFSC's business/EDI processes are often performed by personnel outside of DFSC's direct management or budgetary control.

Coordination of DFSC's EDI process and its related hardware and communications requirements, across this worldwide environment operated by a conglomeration of U.S. Federal activities, will certainly require an extensive plan and an excellent working relationship with all of the players involved.

i. Response

The fifth issue in the personnel environment was developed by the researcher based on EDI education obtained from literature reviews and attendance at EDI training seminars. This area focuses on: "The need for DFSC personnel to educate their contractors on DFSC's EDI program, determining what type of personnel should lead the EDI implementation program, and determining if EDI coordination and implementation should be a full time or part time responsibility for assigned personnel."

j. Analysis

When reviewing the brochures of businesses that are actively engaged in providing EDI implementation services to the commercial business sector, one of the top functions these firms advertise is the ability to educate the company's supplier base on that

company's EDI capabilities and desires [Ref. 22] [Ref. 23] [Ref. 24] [Ref. 25]. While DFSC could theoretically hire one of these service companies to manage their EDI implementation and perform this "advertising" function for them, the most likely scenario is that DFSC will continue to manage their own implementation program. Under this concept, DFSC will need to actively promote their EDI program using internal resources.

In this area, DFSC's contractor base, the U.S. petroleum industry, is already actively embracing the use of EDI technology in several phases of their operations. From the major multi-national corporations in the industry to the small businesses, most of the companies in this industry are active participants in, or at least aware of the EDI technology. One of the major tasks for DFSC's EDI program is to let their contractors know that DFSC is actively involved in pursuing EDI capability and that they are interested in developing new trading partners. This education effort is essential to the expansion of DFSC's EDI program throughout their business operations. Although many companies in the industry are members of the API, the extent to which the participants in the association's meetings are the same personnel who deal with Government contracts via DFSC is limited. Therefore, there exists a need to be able to access the companies' Government representatives who would be directly involved in assisting DFSC's EDI efforts with their company. Accomplishing this objective will require the efforts of DFSC employees who have contact with these industry personnel on a routine basis.

With this need for some portion of DFSC's employees to be involved in actively "advertising" the Center's EDI program, DFSC's management must determine what job classification of employees will become their EDI promoters. While the use of EDI

technology definitely places demands on the computer programmers within an organization, it has commonly been stated that "EDI implementation is comprised of 90% business process modifications and 10% computer program modifications." [Ref. 26] With this concept in mind, DFSC will need people involved in their EDI program who possess both the capability of reaching out to the Center's contractor base and also being able to recognize and manage the business processes that may need to be modified to take full advantage of the capabilities of EDI.

With these duties of the EDI team members in mind, consideration of whether to assign EDI responsibilities as a full-time, or part-time/collateral assignment must be evaluated. Similar to DFSC's decision to return EDI participation to the individual cross-functional business units from its previous centralized management, program participation on a collateral assignment basis would ensure that the EDI team members remain in touch with the work and issues that will affect the EDI program on a day-to-day basis. On the other side of the argument, some of the currently assigned EDI representatives from the CBUs have expressed that they do not have enough time to work on EDI issues with all of their other job responsibilities.

B. SUMMARY

This chapter presented and discussed the issues involved with DFSC's EDI implementation effort, from the perspective of the DFSC employees.

The next chapter presents and discusses the issues involved with DFSC's EDI implementation, from the perspective of DFSC's commercial contractors, and provides additional information on the EDI environment within the U.S. petroleum industry.

IV. EDI IMPLEMENTATION FROM DFSC'S CONTRACTORS PERSPECTIVE

A. GENERAL

Companies within DFSC's contractor base, the American petroleum industry, have been involved in the EDI process for over two decades. Through the industry's trade association, the API, these companies have sought to advance the usage of EDI throughout their business practices. While EDI usage is not evident in all of the companies within API, in 1994, 95% of the companies responding to an API survey indicated they had an active EDI program [Ref. 27:p. 5]

With these impressive statistics on the EDI participation rate within API, and yet DFSC's corresponding low number of active EDI trading partners, a survey was conducted to determine, from the contractor's perspective, what factors may be limiting DFSC's EDI implementation program. Survey responses were received 327 of DFSC's current contractors. Follow up interviews were conducted with 27 of those companies.

1. Question 1

The first survey question was designed to get an estimate of how prevalent EDI usage was within DFSC's segment of the petroleum industry. The question asked: Do you currently utilize EDI in your company's commercial contracting operations?

a. *Response*

Of the 327 companies surveyed, 206 (63%) indicated their company was active in EDI. Of the 121 companies who were not currently utilizing EDI, 52 of them indicated they had plans for EDI implementation in the future.

b. Analysis

The 32% difference in participation percentages between this survey, and the 1994 API survey, are significant. While the API survey's population size of 47 companies may account for a portion of this difference, there may be other factors that affect the percentages. The most significant area may be the target population of both surveys. While the API survey was given strictly to companies that were active members in the association, the researcher's survey was distributed to any company that was doing business with DFSC, regardless of professional association membership.

Based on the results of this survey, EDI activity among DFSC's contractors is high, but maybe not as significant as the API survey may indicate. However, the 66% current participation, and potentially 79% future participation indicate there is significant market for DFSC's program to expand into.

2. Question 2

The survey was next designed to determine why the companies that are active in EDI are not doing business with DFSC via EDI. The survey questioned: "If you currently utilize EDI in your commercial business, but not with DFSC, why?"

a. Response

Four factors were most frequently expressed by the survey respondents, the most common of which was: "We were previously unaware of DFSC's EDI efforts." Many of the companies surveyed indicated that this survey, was the first time they were made aware of DFSC's interest in EDI.

b. Analysis

To date, DFSC's "advertising" program has consisted of one of the DFSC EDI program members making an EDI presentation at contract pre-proposal/bid conferences. Additionally, the 1995 API EDI Conference featured an EDI presentation by two of DFSC's employees and a luncheon with the DFSC Commander as the guest speaker.

These efforts by DFSC to educate their contractor base have only touched the surface of the advertising possibilities that exist in their business environment. While these presentations to selected groups of people have had positive affects, other methods are available to provide further exposure to DFSC's EDI program. Examples include: providing EDI information in all DFSC publications provided to their contractors, including an informational pamphlet with a description of the EDI program along with appropriate points of contact in all contract solicitations, and even contracting with a commercial EDI implementation service to provide education and training to their contractors.

c. Response

The second most frequent response was: "At this point in time, implementing EDI capability with DFSC is not the most cost effective use of our resources."

d. Analysis

The early phases of an organization's EDI plans are often based on achieving a rapid return on investment for the resources expended to implement the EDI capability. Therefore, when creating EDI implementation plans the decision is often made to initially develop trading partner relationships with the organization's highest volume customers first. This allows the company to receive the greatest level of benefits from EDI with a corresponding minimum level of implementation

costs. As a result of this approach, DFSC, based on their existing business volume with some of their contractors, does not present the greatest potential for improvement of those companies' internal processes and therefore does not offer the highest return on investment.

Additionally, as with any new or expanding business program that requires the expenditure of organizational resources to accomplish, EDI must compete within these companies for resource support. When activities are looking at expanding their current EDI operations, they must also consider what other business process improvements they can make using the same resources the EDI program is looking to expend. In some instances EDI may be found to have less financial benefit to the organization than other business improvements they can make. In these cases, EDI may loose out in the competition for limited resources with other internal programs, such as implementing new financial, inventory, or personnel management systems. In a constrained resource environment, for any project to begin or expand, including EDI, its supporters must present a strong cost benefit analysis that outweighs any other proposed programs within the organization.

Finally, EDI implementations are often initially focused on improving an organization's internal processes first, in order to realize the benefits of EDI that provided the justification for the resource expenditures being made to bring this capability on-line. In this area many companies early EDI operations are targeted at implementing transaction sets that automated the processing of data going into their business systems from their "downstream" suppliers, vice transaction sets that process data from their systems into the "upstream" systems of their customers. In this light, these companies would view implementing EDI with DFSC as benefiting DFSC more than themselves. Concentrating

on the upstream side of EDI will often require significant modifications to the companies' internal business processes and business systems, similar to those made to implement their downstream EDI operations, that they may not be able to afford or justify at this time.

e. Response

The third most frequent response was: "We are aware of DFSC's interest in EDI, but we have not been approached by DFSC to actually begin developing EDI capability with them".

f. Analysis

The issues behind this response are closely related to the lack of awareness that some of the other firms expressed. As stated earlier, DFSC's efforts to educate their contractors have largely been limited to presentations made by the EDI program members, to several contractors at a time, during various meetings or conferences. DFSC has not had the dedicated resources to aggressively follow up on these initial contacts, to pursue commitments from the companies to develop a trading partner relationship, and to begin the follow on process analysis, transaction set development, and actual transaction testing that will allow eventual EDI processing. Once an organization like DFSC has educated their targeted trading partner community on the potential benefits of EDI and their own intentions to pursue EDI capability, they must then focus their resources on the efforts required to actually bring the EDI capability on-line.

g. Response

The fourth most frequent response was: "We are waiting to see what rules and regulations DoD and DFSC will put in place for doing business via EDI."

h. Analysis

As stated earlier in this thesis, standardization is the key to EDI processing. Historically the Government, when venturing into new business arenas or practices, has not simply adopted the existing practices or procedures that existed in the commercial business sector, but has developed its own unique rules or procedures. In the world of EDI, the Government's actions concerning EDI standards could have a significant affect on how well commercial firms accept the Government as a potential trading partner. As discussed earlier in this thesis, the API has developed and uses standard ICs throughout their industry, that may not be accepted by DoD/DFSC. A mandate from DFSC to use Federal ICs, as a condition of doing business via EDI, could limit or prevent their contractors' participation in DFSC's EDI program. The use of two different ICs would require companies to perform additional data mapping to do business using the Federal ICs and could potentially force these companies to operate separate computer systems to interface with the Government using one standard, and within their industry using their existing standard. These additional costs to do business via EDI with the Government could make joining DFSC's EDI program not cost effective for their contractors.

3. Question 3

The next objective of the survey was to determine what business processes DFSC's contractors were interested in automating with DFSC, via EDI. The intent was to determine if both DFSC, and its contractors, were interested in targeting the same EDI functions. The following question was posed: What is the most important business function/transaction your company would like to be able to accomplish with DFSC via EDI?

a. Response

The top five responses, by percentage, are presented in Figure 2. These choices by the contractors, as expected, reflect those business transactions that require the most time and effort for the contractors to process. The firms' most prominent response, submitting invoices, was voiced as part of a greater desire to improve the payment process. Many firms expressed a hope that, by submitting invoices via EDI, and then getting paid via EFT, payment times could be reduced to less than one week.

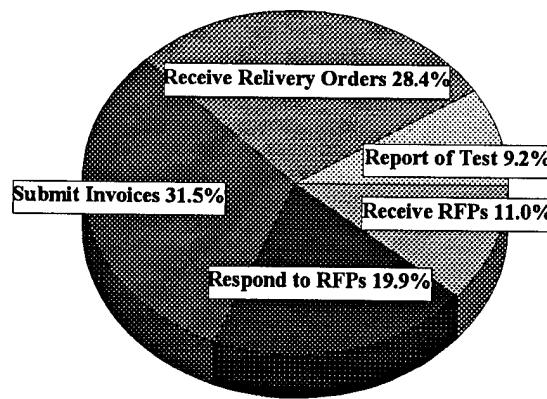


Figure 2. Most Desired EDI Transaction (DFSC Contractors)

b. Analysis

While the commonality between DFSC's employees and their contractors in desiring to use EDI for the issuing and receiving of delivery orders along with the issuing and receiving of contract proposals is a good indicator of potential transaction sets to implement, the processing of invoices via EDI may not meet the desires of DFSC's contractors. In fact, processing invoices via EDI may not result in their companies getting paid in less than 28 days.

Regarding the payment of contract invoices, the Federal Government, as directed by the Prompt Payment Act, is required to pay all properly submitted bills within 30 days. But, this 30 day time frame also functions as the amount of time the Government is allowed to take in making payments, before incurring any interest penalties for late payments. As a result, even though EDI may allow the processing of an invoice to occur much faster, potentially within a matter of hours, the ensuing payment will be made based solely on a financial management decision. Specifically, if the invoice offers discount terms for early payment, that are greater than the current Federal funds borrowing rates, the invoice will be paid as soon as it is verified, in order to take advantage of the discount. If however, the invoice offers no discount for early payment, or a discount that is less than the Federal funds borrowing rate, the invoice will be held for payment until the 28th day after submittal. [Ref. 28]

Upon discussing this payment issue with six of the contractors, five of them indicated they would most likely reevaluate, but not rule out, their desire for automating the invoice transaction. All six contractors indicated that the majority, if not all, of their invoices were currently being paid within the Government's 30 day payment window.

4. Question 4

The survey was next designed to solicit recommendations from the DFSC contractors concerning what actions DFSC should take to increase the use of EDI in their DFSC-contractor relationship. The question was posed: What can DFSC do to improve your existing EDI capability and encourage you to become an EDI trading partner with them?

a. Response

Although several different responses were received, two recommendations were

dominant. Two hundred eleven of the 327 contractors (64.5%) responded that "DFSC should provide more information and education concerning their EDI plans and operating procedures."

b. Analysis

Once again, this recommendation relates to DFSC's efforts to date in advertising their program, which have been discussed previously. Outside of the DFSC organization, several programs are aimed at educating the general DoD contractor base, on the details of the overall DoD EDI program. Examples of these include: the DoD sponsored Electronic Commerce Resource Center (ECRC) Program, which provides outreach services, education and training, consultation, and technical support to the U.S. military industrial base via 11 regional offices; and the DoD Electronic Commerce Office, which provides information on EDI conferences, the Federal Acquisition Regulation, EC and EDI via its home page on the INTERNET.

c. Response

The second recommendation of the contractors, provided by 57 of the firms surveyed, suggested that "DoD and DFSC should allow/support more than one EDI transmission method."

d. Analysis

Eighteen of the surveys, and follow up interviews with twelve of the contractors, indicated that their desire was specifically for the ability to use the "direct connect" method of EDI transmission, discussed earlier in this thesis. The firms expressed concern that with the high volume of EDI transactions they envision doing with DFSC, the transaction charges they would incur by using a VAN communications service, could be excessive. While VAN transaction fees can vary significantly among providers, a review of recent VAN brochures indicates that per transaction rates of less than one dollar are widely available. In order to properly assess the costs of the two

communications options, individual firms would need to perform a comparison of the VAN packages available for their expected transaction volume against the personnel and computer expenses associated with administering a direct connect program.

However, as indicated earlier, as DFSC's number of EDI trading partners increases, any ability DFSC may have to support EDI direct connections, regardless of DoD policy, would be severely limited.

5. Question 5

The final portion of the survey was designed to discover what concerns DFSC's contractors have regarding the implementation of EDI technology in their business environment. The survey question asked: What technical, personnel, legal or other issues are limiting or preventing your use of EDI?

a. Response

Four issues dominated the responses from the firms involved, with the most frequently cited being: "Our company has a lack of budget and personnel resources to apply to the EDI program." Contractors emphasized that EDI must compete with many other programs within the company for resources. Their EDI program is just one of several automation or other productivity improvement programs that are competing for support in a downsizing business environment. Despite the fact that the personnel directly involved with the EDI programs would like to further their implementations, for the benefits they see it can bring to the business processes, they are being faced with the reality that implementing EDI requires the use of many resources.

b. Analysis

The significant point from this issue is the recognition that EDI may not be the most efficient, or cost effective business solution for every transaction, in every environment. When allocating their limited resources, firms are recognizing that EDI is just one of many tools that can be used to make improvements within their organization's processes. In the commercial business environment there are several options available to firms for streamlining their procurement operations such as: the Procurement Card (PROCARD), which is essentially a commercial credit card used in the company's purchasing offices to eliminate the paperwork and procedures involved with writing purchase orders for small dollar value procurements; and Invoice-LESS Payments, where the company's bill payments are initiated by the receipt document, and firms are actually charged a fee if they send the company an invoice [Ref. 29:p. 4]. Companies also recognize that there may be some business functions, that simply do not have the transaction volume to justify an investment in EDI technology. In those instances, EDI is ruled out because its benefits do not outweigh its costs.

c. Response

The second issue voiced by the contractors was the "Difficulty in redesigning internal business practices to take advantage of EDI's capabilities."

d. Analysis

Although most of the firms are well aware of EDI's potential benefits, they are faced with the fact that EDI implementations involve more than just acquiring a new computer or communications system. Typically, an EDI installation will consist of 90% business process modifications and 10% computer program modifications [Ref. 26]. Very often, the business functions that will be streamlined by EDI are imbedded in procedures and internal policies that must

be modified or eliminated in order to utilize the EDI process. In many cases, these policies or procedures have existed in the organization for many years, and have been ingrained in the training and development of the organization's personnel. In this area, several respondents indicated that although their internal EDI program had the support of top management, middle managers and below often failed to provide support to the program. Specifically, functional managers were often unwilling to provide personnel to assist the EDI programs in performing an analysis of their internal business procedures, or if they did provide the assistance, they were often unwilling to approve the changes to the procedures or policies that the analysis indicated were required to allow EDI to function in the process. Even in the cases where firms reported that they had the full support of all personnel in the organization, they indicated that the process of modifying their internal business practices was very labor and time intensive.

e. Response

The third difficulty contractors identified was that "The company's business systems are undergoing a change within the next couple of years, therefore it is hard to justify allocating the time and money required to modify the current systems to further utilize or begin utilizing EDI."

f. Analysis

This issue relates directly to the process of EDI mapping, and its related computer programming that is required to support the EDI process. Similar to the Government, many companies are still operating in a mainframe computer environment, with 1980s or older computer software applications, that are very expensive in terms of time and money to modify. These firms recognize that it is to their advantage to transition to the mini-computer or personal computer environment, and have plans to take their companies in that direction. While in 1994, 53% of

companies in the API were operating on mainframes, in 1995 only 41% still used these systems, and in 1996, mainframe usage is expected to be down to 27% [Ref. 21:p. 10]. In view of this fact, the companies are unwilling to invest money in the form of computer programming, or purchasing of new computer software, that will only provide them benefits for a short period of time until they transition away from their mainframe computers.

g. Response

The final concern voiced by the firms was a "Lack of compliance with the adopted industry guidelines and Implementing Conventions by some of the major petroleum companies."

h. Analysis

This issue is related directly to the problems of using older computer systems and programs, along with the difficulty of modifying an organization's internal business procedures. The specific problem was surfaced predominantly by the smaller companies in the industry, who supply or receive products and services from the larger, multifaceted corporations. Due to the inability or choices, of the large corporations to not perform the computer programming, or modifications to their internal business procedures that are required to fully integrate EDI into their operations, they are unable to comply with the industry's adopted EDI standards. The large corporations often require information from the smaller companies, that is not part of the industry accepted implementing conventions, to fully process the EDI business transaction. As an example: in performing invoice certifications, one corporation's accounts payable department is unable to extract the contract number, which resides in one computer application on one computer system, and the payment cost accounting code, which resides in another computer application on another computer system, in order to process the incoming EDI invoice. To overcome this internal shortcoming, they require the

company submitting the invoice to keep track of these data and submit them as a separate, additional field, in their EDI invoice. These corporations' adoption of this philosophy of "outsourcing" their internal operating inefficiencies, is causing their suppliers to operate multiple systems in order to accommodate these varying EDI "standards."

B. SUMMARY

This chapter introduced and discussed the impediments to DFSC's EDI implementation program, from the perspective of DFSC's commercial contractors. It also provided details on the environment in which DFSC's contractors are conducting their own EDI programs.

The next chapter presents the researcher's conclusions and provides recommendations for DFSC's EDI implementation program.

V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The EDI technology, if fully implemented by DFSC, possesses the capability to bring fundamental change to the way DFSC conducts large portions of its daily business, thus enabling it to meet the demands for change placed upon it. However, the pursuit of this implementation, faces many challenges along the way.

DFSC's involvement in the EDI environment, starting in 1991, has given it a head start on many other DoD organizations. While this early beginning has not resulted in a mature, fully integrated EDI program, it has allowed DFSC to develop a strong level of EDI expertise within their organization. The program's first four years can best be identified as a learning period. The centralized management of these early years probably limited the potential effectiveness of the program, but gave the personnel involved an opportunity to became very knowledgeable about the EDI process. In their centralized office, these personnel were not in a position to see the EDI program through completion. Because they were separated from the front lines of the organization, where the employees have day-to-day contact with DFSC's contractors, they did not have clear access to their target market. Although they were able to make presentations to the contractors at selected meetings and conferences, they lacked the close working relationship with these people that is necessary to take the next steps in the EDI implementation.

Now, with this early learning and exploring behind them, DFSC is poised to aggressively pursue implementation. In doing this, although there are some technology and

computer issues that may slow the program, nothing has been identified that will prevent the program from proceeding. Internally, the current inability to transition DFSC's automated procurement system, to take advantage the 1990s integrated technology they will receive with the replacement of the DFAMS computer system, will continue to make the EDI mapping process take longer, and cost more than it needs to. But, EDI mapping in this environment is not impossible. DFSC's management must recognize that this delay will exist and that extra attention may be needed to ensure that support is provided in this area from DLA's new consolidated ADP organization, DSDC. In the actual communications arena, if DLA is successful in delaying their required transition from the DAASC NEP, to DISA's NEPs, DFSC's transactions should flow without problems in the near term.

DFSC's employees concerns with the legal aspects of EDI all have feasible solutions. Although the hash algorithm, PKE and/or MAC security technologies have not been thoroughly incorporated into all Government and commercial communications systems, these technologies are readily available in the commercial marketplace. Even for the problem of determining timeliness of bids in the EDI contracting process, the EDI technology offers potential solutions for the Government to consider in adopting a policy in this area.

DFSC's largest obstacle appears to be the potential conflict between the petroleum industry's adopted EDI implementing conventions and the Government's desire to create a Federal implementing convention. In this area, the Government's desire to present a single face to industry is conflicting with other Government initiatives to adopt commercial practices in their business processes. While the commercial industries in America have recognized a need for differing ICs to accommodate the unique aspects of individual business sectors, the

Government seems to think they can create a single IC that will satisfy everybody's requirements. If this were true, there would not be a need for ICs at all, the broad based transaction set would work for everybody.

Recognizing that most, if not all of the major industry segments have standards boards that develop and control the ICs for their professions, DoD may be much better off by having their activities adopt the ICs that are already in use in their particular portion of the defense industrial base. In particular; the Naval Air Systems Command could align with the Aerospace Institute of America's standards, The Naval Sea Systems Command could align with standards used in the American Shipbuilding Association, and DFSC would be able to adopt the API's standards.

The current DoD alternative will attempt to force entire industries to abandon their established systems or develop parallel processing systems, in order to be capable of doing business with the Government's EDI system, which for the most part is still in the early developmental stage. If the Government forces industry to switch to the Federal ICs, EDI becomes just one more example of additional expenses in the form of time, dollars, procedures, and equipment that industry must bear in order to do business with the Government. For those companies that make the decision to modify their systems to meet this Government requirement, we, DoD and the U.S. taxpayer, are going to bear these additional costs in the higher prices we will be forced to pay, above and beyond what the truly commercial managed product would have cost us. And to some extent, we may drive some businesses out of the DoD marketplace and prevent others from entering it if they choose not to adopt the Federal ICs. This will have the affect of potentially reducing the competition in

the DoD marketplace and thus, also potentially driving up the prices of the goods and services we acquire.

If the Government does force industry to change their way of doing business, that is going to make their EDI implementations go that much slower. Therefore, if industry needs to go back and modify and/or implement new systems, the issues previously discussed; budget limitations, difficulty in modifying large mainframe systems, modifying internal business processes, etc. are going to prevent them from being able to become Government trading partners anytime in the near future. This would make Government implementations more difficult and more expensive than they need to be, and therefore less successful than they could be.

B. RECOMMENDATIONS

The purpose of this thesis was to evaluate the current status of and issues involved with DFSC's EDI program, with a goal of developing a recommended strategy for DFSC's management to pursue in their ongoing implementation efforts. To that end, the following recommendations are made:

- 1. That DFSC continue the transition of their EDI program from an organization of central management to a program of decentralized control via the organization's CBUs.** This new approach should help in both getting the entire organization further educated on the EDI process, and bringing the EDI implementation to the point of direct interaction with its target market, via the switch away from full-time EDI implementors to part-time EDI facilitators, who perform the organization's business functions on a day-to-day basis.

In choosing the personnel who will lead the EDI work within the CBUs, consideration should be given to what is required and desired from these individuals. These people will be required to evaluate the current business processes within their CBU and explore the possibility of incorporating EDI into those processes as a means of providing improvement. Therefore, they must be experienced enough with the work flow in their CBU to know where and how EDI may fit. Likewise, these people need to currently be, or be willing to become familiar with the EDI technology. To this extent, a strong computer background is not required, but a basic understanding of computer databases and communications will be helpful.

The EDI representatives will also be required to actively interface with the CBU's contractors and with the other Government activities that interface with their internal processes. As such, these people should be in positions where this interfacing is part of their normal daily activity. Likewise, in their education role, the EDI representatives need to take an active role in teaching their fellow workers about the EDI process. Even in this decentralized EDI organization, it is unrealistic to expect that one person in the CBU will be able to make contact with, and facilitate the EDI implementation process with, all of the CBU's external organizations. The CBU representative needs to be a person that is comfortable in passing on their EDI knowledge to the rest of the CBU in order to enhance the EDI effort. Additionally, the CBU's EDI representative will probably need to interact with the other CBU EDI representatives to enhance their own knowledge and to gain any knowledge the others have picked up in their own efforts. To this extent, what is key to getting people capable of this interaction, is the consideration of what these people have done

earlier in their careers, both at DFSC and elsewhere. If they have been in stovepipe organizations, where there has been little interaction outside their work group, these people may find it difficult to approach somebody outside their immediate organization for help. However, if they have had jobs where they have gained some broad experience and participated in a variety of different organizational structures, they most likely are going to feel comfortable in this role of being a team member on a team that is widely spread out. An employee who has had a series of diverse assignments in some of the other DFSC divisions will probably have easier access to this informal network of information.

2. That DFSC conduct an evaluation of where EDI can fit in their overall procurement organization, before pursuing any additional implementations. It is imperative that EDI be recognized as just one of several tools that are available to improve the organization's efficiency. DFSC must look at where EDI fits into the organization's strategic plans. It is logical to look at streamlining the acquisition process in efforts to provide DFSC's energy products to their customers at the best value. In this streamlining effort, there are many options for improving the process; use of Government credit cards, EDI, and simplifying procurement procedures are just a few of the tools that are available. The key is to not allow EDI opportunities to drive the procurement strategy. EDI probably is not the "optimal" solution to every problem or situation. In its EDI program, DFSC could force all of their contractors to do business with them on all transactions via EDI, and yes, DFSC would probably be more efficient. But, EDI may not be the "most" efficient or cost effective means for the contractor or DFSC to do business in all instances. Use of the Government credit card or some other tool, or maybe even leaving some of the smaller

volume transactions in their current manual process, may be the most cost effective approach. DFSC should strive not to "sub-optimize" the acquisition process just to implement EDI, and should consider their supplier's EDI costs when making EDI application decisions.

3. That DFSC maintain a core group of EDI specialists to provide an overall focus to the Center's program, to interface with external policy making organizations, and to participate in EDI professional organizations. While many of the issues involved in the EDI implementation process are internal to the DFSC organization, there still exist several policy issues that are, and will continue to be handled at the DLA, DoD, or Federal level. As a result, there will be an ongoing need for a small group of EDI experts who can deal with these issues by doing the research, developing DFSC's preferred policy, and "selling" the policy to the appropriate decision authority. These people will present DFSC's concerns and desires on the issues and act as the DFSC representative at any meetings or conferences. Additionally, this group can keep current on EDI topics and provide new information to the CBU representatives along with coordinating the overall EDI effort that is being carried out within the CBUs. Their third action would be to join and participate in the professional EDI organizations that are active in the U.S. petroleum industry. Examples of these are the various API EDI user groups; Purchasing and Material Management (P&MM), PIDX, and the newly formed EDI Barrier Busters.

4. That DFSC establish a committee, comprised of representatives from as many of their external organizations as possible, to facilitate the surfacing and resolution of issues outside of DFSC's sole control. In an organization of DFSC's size, doing business throughout the world with a variety of external activities, maximum

participation is essential to the smooth execution of any project like EDI that requires the support and assistance of those activities. Decisions made without the input of these activities may be in error, or even if correct, may lack the required support of the affected activities.

This forum will assist these activities such as DFSC's contractors, the Defense Contract Management Command (DCMC), and the individual Military Service installations in voicing their concerns and/or recommendations regarding DFSC's EDI program. This forum could also be used to address the majority of the issues that simply require a technical or procedural solution that does not require a policy decision outside of DFSC, by providing people who are capable and willing to do the research to identify a "best practice" within DoD or the commercial industry, and see that practice through implementation.

5. That DFSC expand the formal advertising of their EDI program. DFSC's efforts to date in this area have only had marginal success. And, although DoD has established several programs to educate the defense industrial base on DoD's EDI program, these efforts will most likely miss DFSC's contractor base, which for the most part only interacts with the DoD when dealing specifically with DFSC. Once DFSC's contractors are made aware of the Center's EDI desires, many of them may approach DFSC to become trading partners, based on their own existing EDI programs. Opportunities for further advertising include; preparing pamphlets describing DFSC's program for distribution to all of DFSC's current contractors, distributing these pamphlets with all contract solicitations, and including an EDI segment in DFSC's recently established home page on the World Wide Web.

6. That DFSC conduct formal training specifically for their middle management personnel. Although it is always preached that EDI programs must have top

level support, middle management support is just as important, if not more. These are the people who directly control the budgetary and personnel resources that are required for the program to succeed. Additionally, as the leaders within their individual portions of the organization, they set the tone for how EDI will be accepted and supported. Many of these people may be feeling left out of the EDI process due to the fact that direction from the program is coming from the top of the organization, and the actual work and knowledge is residing in the lower levels of the organization. It is critical that these personnel have the opportunity to receive education about EDI, in a setting separate from the people who work for them, and from their bosses. In this environment, they should feel free to ask more questions and voice their concerns about EDI, without feeling that they are undermining top management's desires in front of their people or second guessing management in front of their bosses. Through this process, they will receive a combination of having their fears of EDI alleviated and having the concerns that their years of experience bring to them presented for consideration in the EDI program. As a result, their level of support should be much higher.

C. RECOMMENDATIONS FOR FURTHER RESEARCH

During this research process, several areas for further research relating to the implementation of EDI were identified. These areas include:

- An evaluation of DoD's Electronic Commerce Resource Center (ECRC) programs.

Is the program capable of reaching all segments of the DoD contractor base? Will the program's efforts satisfy the needs of all DoD activities, or is there a need for some activities to establish their own programs targeted specifically at their segment of the

DoD industrial base? Is the program truly operating as an independent education source or is it steering customers to specific EDI approaches and products?

- A comprehensive evaluation of DoD's chosen EDI communications architecture to include documenting the basis on which DoD adopted their Network Entry Point (NEP) philosophy? What advantages does this approach provide DoD? What disadvantages arise from this approach? What alternatives are available?
- A review of the Corporate Information Management (CIM) program. Why was the program created? What are the program's objectives? What progress has been made? What are the drawbacks of the program? Is the CIM strategy still applicable or desired in lieu of DoD's current emphasis on moving to Commercial Off The Shelf (COTS) computer technology?
- An analysis of the applicability and roles of the Government Credit Card and EDI in the Government acquisition process. What are the advantages of each? What are the disadvantages of each? In what type of procurement is one more cost-effective than the other?
- What policy should the Government adopt for determining timeliness of receipt of bids, in the EDI sealed bidding process? What options are available? What is commercial industry doing?
- What should the Government's policy be concerning the use of implementing conventions (ICs) in the EDI process? Why are ICs needed? What ICs are currently being used? Should the Government create their own ICs? Is a single Federal IC cost-effective for the Government? Is a single Federal IC technically achievable?

APPENDIX
LIST OF ABBREVIATIONS

ADP	Automated Data Processing
ANSI	American National Standards Institute
API	American Petroleum Institute
ASC	Accredited Standards Committee
BIC	Business Information Center
BBS	Bulletin Board System
CBU	Commodity Business Unit
CIM-P	Corporate Information Management-Procurement
CONUS	Continental United States
COTS	Commercial Off The Shelf
DAASC	Defense Automated Addressing Systems Center
DCMC	Defense Contract Management Command
DES	Digital Encryption Standard
DFAMS	Defense Fuel Automated Management System
DFSC	Defense Fuel Supply Center
DISA	Defense Information Systems Agency
DLA	Defense Logistics Agency
DMR	Defense Management Review
DMRD	Defense Management Review Decision

DoD	Department of Defense
DSDC	Defense Systems Design Center
EC	Electronic Commerce
EDI	Electronic Data Interchange
EFT	Electronic Funds Transfer
E-mail	Electronic mail
FACNET	Federal Acquisition Computer Network
FAR	Federal Acquisition Regulation
FAX	Facsimile
FY	Fiscal Year
GAO	General Accounting Office
GSA	General Services Administration
IC	Implementing Convention
ICP	Inventory Control Point
IMM	Integrated Item Manager
MAC	Message Authentication Code
NEP	Network Entry Point
NPR	National Performance Review
OSD	Office of the Secretary of Defense
PIDX	Petroleum Industry Data Exchange
PIP	Program Implementation Plan
PKC	Public-Key Cryptology

P&MM	Purchasing and Materials Management
PROCARD	Procurement Card
RFP	Request For Proposal
RFQ	Request For Quotation
SAT	Simplified Acquisition Threshold
TDCC	Transportation Data Coordinating Committee
TPA	Trading Partner Agreement
UN/EDIFACT	United Nations, Electronic Data Interchange for Administration, Commerce, and Transportation
VAN	Value Added Network

LIST OF REFERENCES

1. Deputy Under Secretary of Defense (Acquisition Reform), "DoD Electronic Commerce (EC)/Electronic Data Interchange (EDI) In Contracting Report", Washington, D.C., 20 December 1993.
2. Drake, D.J., "Electronic Data Interchange Opportunities in Defense Procurement", Logistics Management Institute, Report DL203R2, Bethesda, MD, May 1992.
3. Defense Logistics Agency, "DoD Implementation Guidelines for Electronic Data Interchange", Volume 1, Cameron Station, Alexandria, VA, December 1991.
4. Robert Lyttle and Associates, "EDI Tutorial," Presentation at the 1995 American Petroleum Institute EDI Conference, 25 September 1995.
5. Defense Logistics Agency, "Electronic Commerce: A Strategic Plan for DoD", Cameron Station, Alexandria, VA, November 1990.
6. Data Interchange Standards Association, "An Introduction to Electronic Data Interchange", Alexandria, VA, 1990.
7. Office of the Deputy Under Secretary of Defense (Acquisition Reform), "Electronic Data Interchange Implementation in Contracting", Washington, D.C., February 1995.
8. Defense Information Systems Agency, "EC/EDI Implementation Conventions", October 1995.
9. Taft, W.H., "Electronic Data Interchange of Business-Related Transactions", Deputy Secretary of Defense Memorandum, Washington, D.C., 24 May 1988.
10. Office of the Secretary of Defense, "Implementation of Electronic Data Interchange in DoD", Washington, D.C., 12 November 1991.
11. Murphy, D.R., "Electronic Commerce: The Way the Federal Government Will Do Business", National Contract Management Association; Topical Issues In Procurement Series, Vienna, VA, July 1994.
12. Clinton, W., "Streamlining Procurement Through Electronic Commerce", Presidential Memorandum, Washington, D.C., 26 October 1993.
13. The National Contract Management Association, "Federal Acquisition Streamlining Act of 1994, Volume 1, The Law", Vienna, VA, 1994.

14. Telephone conversation between Mr Philip Church, Director, Business Process Reengineering Team, Defense Logistics Agency and the author, 22 September 1995.
15. Telephone conversation between CDR Anthony Frontero, EDI Project Manager, Naval Supply Systems Command and the author, 24 August 1995.
16. McCarthy, S., "EDI Traffic Jam Forces DLA to Stick to Its Own Route", Government Computer News, 5 June 1995.
17. Drake, D.J., Ciucci, J.A., and Ledder, W.R., "Electronic Commerce, Removing Regulatory Impediments", Logistics Management Institute, Report DL203R1, Bethesda, MD, May 1992.
18. General Accounting Office Memorandum, "Electronic Contracting", File B-238449, Washington, D.C., June 1991.
19. Federal Electronic Commerce Acquisition Team, "Streamlining Procurement Through Electronic Commerce", Falls Church, VA, 13 October 1994.
20. Department of Defense, "Status of the Department of Defense Corporate Information Management (CIM) Initiative", October 1993.
21. O'Quinn, M., "Early Survey Results Are In!", American Petroleum Institute, Purchasing and Materials Management User Group Newsletter, 25 September 1995.
22. "How To Enable Targeted Trading Partner Communities", Harbinger EDI Services Inc., October 1995.
23. "Commerce*Express Services: A Primer", GE Information Services Inc., 1994.
24. "AT&T Electronic Commerce (EC) Consulting Services", AT&T EasyLink Services, 1995.
25. "Electronic Commerce, EDI, and Business Process Reengineering", Electronic Commerce Strategies, Inc., 1995.
26. Little, R., EDI Tutorial presented at the American Petroleum Institute 1995 EDI Conference, 25 Spetember 1995.
27. Purhasing and Materials Management Users Group, "EDI General Usage Survey," American Petroleum Institute, September 1995.

28. Telephone conversation between Mr Timmothy Gates, Electronic Data Interchange Coordinator, Defense Finance and Accounting Service and the author, 13 September 1995.
29. Shell Services Company, "Total Procurement Process: Adding Value Through The Total Cost OF Ownership", 1995.

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